ENVIRONMENTAL MONITORING AND ASSESSMENT PROGRAM SURFACE WATERS FIELD OPERATIONS MANUAL FOR LAKES

The information in this Adobe Acrobat Reader PDF file is one of several PDF files extracted from this report. The PDF files from the report are:

lake_ove.pdf	Overview of EMAP Surface Waters Lake Sampling, daily operations, lake verification and index site location, and general lake assessment (Sections 1, 2, 3, 4, 9)
lake_hab.pdf	Protocols for temperature, dissolved oxygen, shoreline physical habitat (Section 5)
lake_fis.pdf	Protocols for fish sampling (Section 6)
lake_wat.pdf	Protocols for Secchi transparency, water sample collection, chlorophyll a, zooplankton, sediment diatom (Section 7)
lake_ben.pdf	Protocols for benthic invertebrate sampling (Section 8)
lake_avi.pdf	Protocols for avian assemblages (Appendix A)
lake_vis.pdf	Lake-Visit Checklists for all Field Measurements (Appendix B)
field_for.pdf	Field Data Forms for all Field Measurements (Appendix C)

The Table of Contents, acknowledgments, notice page, listing of figures, listing of tables, and listing of acronyms for the document appear at the end of each pdf file.

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ENVIRONMENTAL MONITORING AND ASSESSMENT PROGRAM SURFACE WATERS

FIELD OPERATIONS MANUAL FOR LAKES

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ABSTRACT

The methods and instructions for field operations presented in this manual for lake surveys were developed and tested through 4 years of pilot and demonstration projects from 1991 through 1994. These projects were conducted under the sponsorship of the U.S. Environmental Protection Agency and its collaborators through the Environmental Monitoring and Assessment Program (EMAP). This program focuses on evaluating ecological conditions on regional and national scales. This document describes procedures for collecting data, samples, and information about biotic assemblages, environmental measures, or attributes of indicators of lake ecosystem condition. The procedures presented in this manual were developed based on standard or accepted methods, modified as necessary to adapt them to EMAP sampling requirements. In addition to methodology, additional information on data management and other logistical aspects is integrated into the procedures and overall operational scenario. Procedures are described for collecting chlorophyl *a*, water, sedimentary diatoms, and zooplankton data in conjunction with the development of standard methods to obtain acceptable index samples for macrobenthos, fish assemblage, fish tissue contaminants, riparian birds, and physical habitat structure. The manual describes field implementation of these methods and the logistical foundation constructed during field projects. The manual includes flow charts with overall summaries of specific field activities required to visit a lake site and collect data for these indicators. Tables give step-by-step protocol instructions. These figures and tables can be extracted and bound separately to make a convenient quick field reference for field teams. The manual also includes example field data forms for recording measurements and observations made in the field and sample tracking information. Checklists of all supplies and equipment needed for each field task are included to help ensure that these materials are available when required.

APPENDIX B

LAKE-VISIT CHECKLISTS

LAKE-VISIT CHECKLISTS

Items in Forms File	Number Needed Each Lake
Lake information packet for lake to be sampled; includes:	1
Benthic Sample Location and Collection Form	2
Physical Habitat Sketch Map Form	2
Lake Verification Form	1
Lake Profile Form	2
Sample Collection Form	2
Lake Assessment Form	2
Physical Habitat Characterization Form	2
Physical Habitat Comments Form	3
Blank Map Forms (Benthic, Verification, and Sketch Map)	5 each
Fish Tally Form	50
Fish Tally Continuation Form	10
Fish Length Form	10
Fish Tissue Tracking Form	2
Field notebook	1
Field Operations Manual	1
Taxonomic keys set	1
Sediment cores label sheet	1
Zooplankton label sheet	1
Fish tissue label sheet	1
Water chemistry label sheet	1
Chlorophyll label sheet	1
Voucher tag sheet	1 set
EMAP pamphlets	20
Sampling permit	1
Quick reference handbook	1
Shipping airbills	10

S	M	T	W	T	F	S	Items in the Boat	Number Needed Each Lake
							Life vests	3
							Anchor with 50-m line and float	1-2
							Bailing bucket	1
							Air horn	1
							Oars, pair	1
							First aid kit	1
							Spare tire (trailer)	1
							Trailer straps	2
							Transom plug	1
							Bow light with good batteries	1
							Stern light with good batteries	1
							Bow line, 5-m	1
							Fuel tank with gas and oil	1
							PVC pipe, 3-m length	1
							Indiana trap nets	1 per expected number of sets
							Beach seine	1
							Short-haul line	1

Items in 80-qt Cooler #1	Number Needed Each Lake
Sonar unit with manual	1
Transducer with bracket and C-clamp	1
12-V wet cell battery (charged) in battery case	1
GPS unit with manual, reference card, extra battery pack	1
Inflatable viewing box	1
Items in 80-qt Cooler #2	**Number Needed Each Lake**
Corer with 50-m line and messenger	1
Sediment core tubes	2
Ground rubber stoppers	4
Extruder pipe	1
Sectioning stage	1
Sectioning tube	1
Siphon with L fitting	1
Plastic container (with lid) with two 1-qt self-sealing plastic bags	1
Items in 80-qt Cooler #3 (Shipping Cooler)	**Number Needed Each Lake**
0.5-gal bottles or 1-gal bottles	4
Borate buffered formalin, 40 percent	1 gal
Bleach, 1 qt	1
Vermiculite (or other absorbent), 4 qts	1
Cooler liner (30-gal garbage bag)	1
1-qt self-sealing plastic bags with punched holes	25
1-gal self-sealing plastic bags with punched holes	20
Butyl gloves	1 pair
Safety glasses	2 pair

Items in Cooler for Benthic Sampling	Number Needed Each Lake
Sieve bucket	1
Plastic funnel	1
Rinse bottle, 500-mL	1
Screen top lid (60-mesh) for sample containers	1
Sample containers, 500-mL (marked at 400-mL)	10
Heavy-duty self-sealing plastic bags, 1-gallon, labeled with station ID	10
Garbage bags, large kitchen size (for storing sample containers)	2
60-cc plastic syringe for dispensing formalin	1
Carbonate buffered formalin solution	500 mL
Surgical gloves	2 pair
Large plastic tub	1

Items in 48-qt Cooler #1 (Limnology Shipping)	Number Needed Each Lake
Plastic container with lid	1
Syringes, labeled	4
Syringe valves	4
Surgical gloves	2 pair
Cubitainer, 4-L	2
Ice in 1-gal self-sealing plastic bags	6
Cooler liner (30-gal garbage bag)	1
Items in 48-qt Cooler #2 (Fish Tissue Shipping)	**Number Needed Each Lake**
Ice in 1-gal self-sealing plastic bags	4
Cooler liner (30-gal garbage bag)	1
Foil, 25 yards	1
1-qt self-sealing plastic bags	10
1-gal self-sealing plastic bags	10
Composite bags (30-gal garbage bags)	4
Items in 48-qt Cooler #3	**Number Needed Each Lake**
Ice in 1-gal self-sealing plastic bags	4
Cooler liner (30-gal garbage bag)	1

Items in Tub #1	Number Needed Each Lake
Van Dorn with 3-m line, messenger	1
1-L wash bottle (labeled) with distilled or deionized water (DI)	1
Secchi disk	1
Sounding chain, 50-m with quick-clip	1
2-L bottle of sucrose solution	1
Parts tackle box (see below)	1
Chlorophyll tackle box:	1
Filter apparatus with filter installed	1
Hand pump with tubing	1
Box of filters (Whatman GF/F) in self-sealing plastic bag	1
Forceps in bag with filters	1
Graduated cylinders, 100-mL and 250-mL	1 each
10-cm squares of foil in self-sealing plastic bag	3
Zooplankton net bag:	1
Bongo net	1
Fine mesh and coarse-mesh buckets	1 each
Sample jars, 125-mL Nalgene (with formalin/sucrose solution)	2
Narcotization chamber	1
Alka Seltzer tablets	10
125-mL brown bottle with borate-buffered formalin, 40%	1
125-mL brown bottle with sucrose solution	1
60-mL syringe for dispensing formalin and sucrose solutions	1
Empty 125-mL Nalgene bottles	2

Items in Tub #2 (Trap Net Accessories)	Number Needed Each Lake
Anchors with 0.5-m line and quick-clips	3 per each net used
Floats with 1.5-m line and quick-clips	3 per each net used
Floats with 4-m line and quick-clips	5
Net repair twine, roll	1

Items in Tub #3 (Gill Net Accessories)	Number Needed Each Lake
Anchors with 0.5-m line and quick-clips or mesh bags to make anchors	2 per net
Floats with 1.5-m line and quick-clips	3 per bottom set 8 per surface net
Line sections of 5-m (clips on both ends)	10
Line sections of 10-m (clips on both ends)	10
Line sections of 30-m (clips on both ends)	10

Items in Tub #4	Number Needed Each Lake
Minnow traps with clips	6
Floats with 1.5-m line and quick-clips	6
5-gal buckets	2

Items in Tub #5	Number Needed Each Lake
Livenets, with floats	2
Dip nets	2
Waders	2 pair
Headlamps with good batteries (size C)	3
Q-beam with pigtail adapter	1
12-V wet cell battery (charged) in battery case	1

Items in Tub #6	Number Needed Each Lake
Swedish experimental gill nets	1 per no. of sets
Fish measuring board	1

Items in Parts Tackle Box	Number Needed Each Lake
Leatherman or Swiss Army knife	1
Pencils (and sharpener)	5(1)
Marker (permanent)	3
Extra sample labels	1 set
Alka Seltzer tablets	10
Syringe valves (in 1-qt self-sealing plastic bags)	10
Surgical gloves (in 1-qt self-sealing plastic bags)	10 pair
Paper towels	1 roll
Self-sealing plastic bags, 1-qt, 1-gal (in 1-qt self-sealing plastic bag)	10
Clear tape strips, box	1
Foil squares, 10-cm (in 1-qt self-sealing plastic bag)	10 squares
Forceps, watchmakers (pointed)	1
Forceps, Teflon (flat)	1
Messenger (for Van Dorn or corer)	1
Field thermometer, alcohol	2
Surveyor's ribbon	1 roll
Syringes	2
Batteries (AA, C, and D size)	9 AA, 4C, 6D
Electrical tape, roll	1
Strapping tape, roll	2
Metric tape measure	1
Compass	1
Solar calculator	1
O ring (corer)	2
Insect repellent	1
Screwdriver for corer	1
Headlamp	1
Hole punch	1
Pocket magnifier	1
Cotter pins	6
Crescent wrench	1
Pliers	1
"Cyalume" light sticks	6

D.O. Meter Kit in Soft Cooler	Number Needed Each Lake
Meter and manual	1
Cable and probe	1
Membrane kit and filling solution	1
Extra O-rings	1
Calibration chamber	1
Storage bottle	1

Items in Trucks	Number Needed Each Truck
Spare tire	1
Jack	1
Lug wrench	1
Shovel	1
Saw	1
Axe	1
Come-along	1
Camping gear, set	1
Food supply	1
Drinking water supply	1
Tool kit	1
Tow strap or heavy rope	1
Battery charger	1
Jumper cables	1

Information Management Items	Number
Portable computer	1
Phone cord	1
Power supply	1
Power cord	1
Extra computer battery	1
Computer carrying case	1
Surge protector	1
Kodak printer	1
Printer power supply	1
Printer carrying case	1
Computer/printer connection cable	1
Printer cartridge	1
Bar code reader	1
Bar code power supply	1
Extension cord	1
Plug adaptor 3 to 2	2
Filament tape	4
Box sealing tape	2
Boxes of 3 1/2 disks, (10 each)	2
Packs of tape pads	10
Purple file containing sample labels and bar codes	1
Purple file containing blank labels	1
Manila file containing supply replenishment forms	1
Brown file containing weekly report forms	1
Large envelope containing all weather writing paper	1
Empty folders	2
Folder containing shipping and tracking paper backup	1
Computer and printer manual	1
User's Guide	1
Envelope containing overnight shipping airbills	1

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FIGURES

TABLES

ACKNOWLEDGMENTS

In any undertaking with a scope as broad as that of EMAP-Surface Waters, many individuals contribute in important ways not reflected by authorship on documents such as this. This is especially true of the contents of this manual which are the product of tests and lessons learned over a period of 5 years of field work. Rather than attempt to list all of these contributors, and risk omitting some, we will identify the organizations whose staff members participated in the development of the material presented in this manual:

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ACRONYMS AND ABBREVIATIONS

BPJ	Best Professional Judgment
DLGs	Digital Line Graphs
DO	dissolved oxygen
EMAP	Environmental Monitoring and Assessment Program
EPA	U.S. Environmental Protection Agency
GPS	Global Positioning System
GQ	geometric quality
ID	identification
ORD	Office of Research and Development
OSHA	Occupational Safety and Health Administration
P-Hab	physical habitat
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
SQ	signal quality
STARS	Sample Tracking and Reporting System
T	Top
TIME	Temporally Integrated Monitoring of Ecosystems
USGS	United States Geological Survey
YOY	young of year
YSI	Yellow Springs Instrument system

Measurement Units

ha	hectare
m	meter
ppm	parts per million